New regimes to achieve enhanced transmission through subwavelength hole arrays

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Abstract: In this communication we present millimetre- and THz-waves experimental confirmation of enhanced transmission through subwavelength hole arrays with rectangular lattice when the incident electric field is parallel to the short periodicity.

Extraordinary optical transmission (EOT) [1] has become one of the hot topics of this century because of its potential to a wide range of application, such as polarization control, biosensing, non-linear optics and absorption spectroscopy to name a few [2]. This phenomenon is founded, roughly speaking, on complex surface waves (surface plasmon polariton at optics, leaky or Sommerfeld-Zeneck waves at microwaves-to-THz) [3] supported by the texturized metal and the evanescent coupling though the holes [1].

Given the impact of EOT in science and industry, alternative routes to enhance the transmission through subwavelength apertures are being exploring. One that has attracted little attention up to day is the enhancement for s-polarized waves through dielectric sandwiched hole [4] and slit arrays [5]. Although at a first sight it looks counterintuitive, its underlying physics is also based on a complex surface waves as the case of regular EOT. However, in this case, the complex surface wave is a waveguide mode supported by the metallic-backed dielectric slab [3, 4].

Here, we show the TE nature of this waveguide mode (see figure below) and we demonstrate experimentally enhanced transmission through dielectric loaded subwavelength hole as well as slit arrays at millimetre-waves and THz [6, 7].

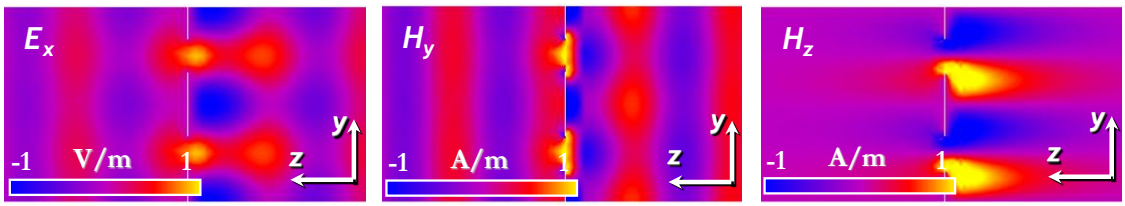

Fig. 1. Electric and magnetic field distribution for the anomalous EOT.

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